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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/747,583	12/21/2000	Daniel Leibholz	SMQ-023	3889

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LAHIVE & COCKFIELD
28 STATE STREET
BOSTON, MA 02109

EXAMINER

HARKNESS, CHARLES A

ART UNIT	PAPER NUMBER
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2183

DATE MAILED: 12/01/2003

5

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

09/747,583

Applicant(s)

LEIBHOLZ ET AL.

Examiner

Charles A Harkness

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 December 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>4</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

Papers Submitted

1. It is hereby acknowledged that the following papers have been received and placed of record in the file: Drawings as received on 04/23/01; and Information Disclosure Statement as received on 10/15/02.

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.
3. The applicant or their representatives are urged to review the specification and submit corrections for all mistakes of a grammatical, clerical, or typographical nature.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-2 and 8-19 rejected under 35 U.S.C. 102(e) as being anticipated by Lin U.S. Patent Number 6,631,452 (herein referred to as Lin).

5. Referring to claims 1 and 14 Lin has taught. A microprocessor, comprising:
registers for holding values, wherein said registers are logically partitioned into register windows (Lin figure 2, figure 4, column 4 lines 1-29; the frames are the register windows);

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a storage for storing values held in the registers of the register windows (Lin figure 2, figure 4, column 4 lines 1-29; the backing store);

a detector for detecting that one of a register window overflow condition and a register window underflow condition is imminent (Lin column 8 line 49-column 9 line 5, figure 6; the mandatory fill and spill operations come from underflow and overflow conditions); and

an instruction generator responsive to the detector for generating at least one instruction to manipulate the storage to avoid a trap responsive to the condition that is detected as imminent (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract).

6. Referring to claims 2 and 15 Lin has taught wherein the detector and the instruction generator are implemented in hardware (Lin column 11 lines 1-15).

7. Referring to claim 8 Lin has taught wherein the detector detects solely whether a register window underflow condition is imminent (Lin column 11 lines 40-43).

8. Referring to claim 9 Lin has taught wherein the detector detects solely whether a register window overflow condition is imminent (Lin column 11 lines 35-39).

9. Referring to claim 10 Lin has taught wherein the detector detects both whether a register window overflow condition is imminent and whether a register window underflow condition is imminent (Lin column 8 line 49-column 9 line 5, figure 6; the mandatory fill and spill operations come from underflow and overflow conditions).

10. Referring to claim 11 Lin has taught wherein the microprocessor further comprises an execution unit for executing the instruction generated by the instruction generator (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 4).

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11. Referring to claim 12 Lin has taught wherein the microprocessor performs out of order execution of instructions (Lin column 3 lines 32-45; speculative processing by definition is not a certain operation, but is a prediction based on some information, and because of a misprediction, the wrong order of operations will occur).

12. Referring to claim 13 Lin has taught wherein the instruction generator includes a second storage for holding the at least one instruction that is generated by the instruction generator (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract; it is inherent that some ROM or other memory would be available to hold the speculative operations, that the RSE chooses to executes).

13. Referring to claim 16 Lin has taught a microprocessor having a plurality of registers logically partitioned into register windows and a storage for storing contents of register windows, a method, comprising the steps of:

determining that one of a register window spill and a register window fill is imminent (Lin column 8 line 49-column 9 line 5, figure 6, column 5 line 46-column 6 line 2, abstract; the mandatory fill and spill operations come from underflow and overflow conditions); and

in response to determining that the register window spill is imminent, manipulating the storage to avoid a trap responsive to the spill or the fill determined as imminent (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract).

14. Referring to claim 17 Lin has taught wherein, when it determined that a register window spill is imminent, the step of manipulating the storage comprises providing at least one instruction for execution by the microprocessor that causes the contents in at least the selected

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register window to be stored in the storage (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract).

15. Referring to claim 18 Lin wherein, when it is determined that a register window fill is imminent, the step of manipulating the storage comprises providing at least one instruction for execution by the microprocessor that causes data in the storage to be stored in the registers (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract).

16. Referring to claim 19 Lin has taught wherein the microprocessor has an instruction stream slated for execution and wherein the instruction that causes the contents in at least the selected register window to be stored in the storage is inserted into the instruction stream (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 4; the instruction stream is the operations in figure 4 that spill and fill the registers from memory).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. Claims 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin.

18. Referring to claim 3 Lin has not taught wherein the microprocessor further comprises a cache for caching instructions for introduction into an execution stage and wherein the detector examines the instructions in the cache to determine if a register window overflow condition is imminent by determining if execution of any of the fetched instructions will result in a register

window overflow condition. However Lin has taught that it is desirable to monitor instructions to be able to see if one of those instructions will cause a mandatory stall, and if an instruction is found that does, to speculatively fill and spill the registers in the stack to save or restore the registers to prevent the stall from happening (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6). One of ordinary skill in the art at the time of the invention looking at Lin would recognize that Lin is teaching to look ahead to see what is going to happen with the instructions. Therefore, one of ordinary skill in the art at the time of the invention looking at Lin would recognize the advantage of looking further up the instruction path into the instruction cache to see what instructions are coming up, to give the system even more time to save or restore registers to prevent exceptions and stalls and traps, which consume time. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to look in the instruction cache for instructions that would cause a stall to prevent the stall from happening to reduce the time needed for execution.

19. Referring to claim 4 Lin has taught wherein the detector looks for an instruction in the cache that stores contents of a register window in the registers when the registers have no available space for storing the contents (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6, column 8 line 49-column 9 line 5).

20. Referring to claim 5 Lin has taught wherein the detector examines how much storage space is available in the registers (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6, column 8 line 49-column 9 line 5).

21. Referring to claim 6 Lin has not taught wherein the microprocessor further comprises a cache for caching instructions for introduction into an execution stage and wherein the detector

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examines the instructions in the cache to determine if a register window underflow condition is imminent by determining if execution of the instructions will result in a register window underflow condition. However Lin has taught that it is desirable to monitor instructions to be able to see if one of those instructions will cause a mandatory stall, and if an instruction is found that does, to speculatively fill and spill the registers in the stack to save or restore the registers to prevent the stall from happening (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6). One of ordinary skill in the art at the time of the invention looking at Lin would recognize that Lin is teaching to look ahead to see what is going to happen with the instructions. Therefore, one of ordinary skill in the art at the time of the invention looking at Lin would recognize the advantage of looking further up the instruction path into the instruction cache to see what instructions are coming up, to give the system even more time to save or restore registers to prevent exceptions and stalls and traps, which consume time. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to look in the instruction cache for instructions that would cause a stall to prevent the stall from happening to reduce the time needed for execution.

22. Referring to claim 7 Lin has taught wherein the detector looks for an instruction in the cache that restores a register window when contents of the register window are stored on the stack rather than in the registers (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6, column 8 line 49-column 9 line 5).

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Conclusion

23. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure as follows. Applicant is reminded that in amending in response to a rejection of claims, the patentable novelty must be clearly shown in view of the state of the art disclosed by the references cited and the objections made. Applicant must also show how the amendments avoid such references and objections. See 37 CFR 1.111(c).

Panwar et al., U.S. Patent Number 5,941,977, has taught an apparatus for handling register windows in an out-of-order processor.

Goebel, U.S. Patent Number 6,131,188, has taught a system and method for reducing the occurrence of window use overflow.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles A Harkness whose telephone number is 703-305-7579. The examiner can normally be reached on 8:00 A.M. – 5:30 P.M. with every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on 703-305-9712. The fax phone numbers for the organization where this application or proceeding is assigned are 703-746-7239 for regular communications and 703-746-7238 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-7579.

Charles Allen Harkness

Patent Examiner

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November 25, 2003


EDDIE CHAN
SUPERVISORY PATENT EXAMINER
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